PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ^{6} :
F16L 11/08, 11/118, 11/127

A1

(11) International Publication Number: **WO 98/25064**

(43) International Publication Date: 11 June 1998 (11.06.98)

(21) International Application Number: PCT/EP97/04949

(22) International Filing Date: 10 September 1997 (10.09.97)

(30) Priority Data:
VI96A000202 6 December 1996 (06.12.96) IT

(71) Applicant *(for all designated States except US)*: FITT S.P.A. [IT/IT]; Via Piave, 4, I-36066 Sandrigo (IT).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: MEZZALIRA, Rinaldo [IT/IT]; Via Breganzola, 3, I-36057 Arcugnano (IT).

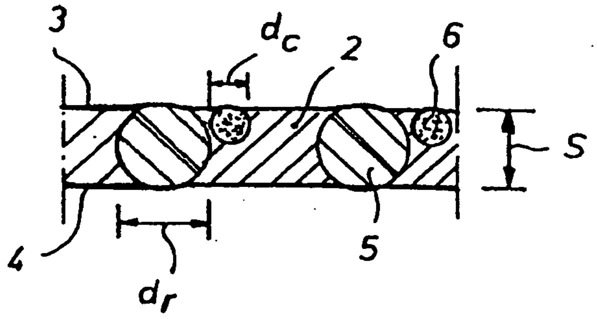
4) Agent: WAGNER & GEYER; Gewürzmühlstrasse 5, D-80538 München (DE).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: ANTISTATIC FLEXIBLE HOSE

(57) Abstract



An antistatic flexible hose includes: a base layer (2) of relatively elastic plastic material, in which a first helical wire-like reinforcement part (5) with a preset pitch, made of rigid plastic, is embedded; antistatic devices constituted by a helical wire-like part (6) made of an electrically semiconduct- plastic compound which is co-extruded together with the base layer (2) and is embedded therein. The semiconducting wire-like part (6) has the same pitch as the wire-like reinforcement part (5) and can be arranged outward or inward in a position which is adjacent and offset with respect to the reinforcement part (5) toward the inner surface (4) or outer surface (3) of the base layer (2), so as to be tangent to them or at least partially radially protrude inward or outward. The semiconducting body is constituted by a plastic matrix, made for example of ethylene and vinyl acetate copolymers, in which a solid material with a relatively low electrical resistivity, for example a carbon black-based powder, is dispersed.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

ANTISTATIC FLEXIBLE HOSE

The present invention relates to an antistatic flexible hose, generally adapted to convey fluids, and particularly gaseous substances, possibly containing solid particles.

A typical application of the flexible hoses according to the invention is in ducts for connecting conventional household and industrial aspirator units to the corresponding suction connectors to convey dust and other solid particles dispersed in the air stream.

The structure of conventional flexible hoses of the above described type, known commercially as helically-wound hoses, generally includes a base layer of relatively elastic plastic material in which at least one wire-like reinforcement part, made of substantially rigid plastic material, is embedded, which gives the base layer transverse rigidity and is substantially shaped like a helix with a preset pitch.

A problem of these conventional flexible hoses is that the solid particles of insulating materials which are scattered in the air stream produce, owing to their friction against the walls of the hose, electrostatic charges which accumulate locally on the outer surfaces of the hose. During use, the accumulated charges can discharge suddenly through the ionized air, producing sparks, with considerable danger for users, especially in industrial or household environments and in the presence of flammable products.

Furthermore, the electrostatic charging of the hose causes a considerable amount of dust, and of other solid residues scattered in the air, to deposit on the walls of the hose and on the walls of the devices to which the hose is fitted.

In order to obviate this drawback, an attempt has been made to make the hoses antistatic, that is to say, to provide them with devices for discharging the charges across an electrical conductor having various shapes which is connected to the ground line of the suction device.

An example of embodiment of this electrical conductor is constituted by a metal wire or band which is wrapped in a spiral shape and is anchored to the base layer next to the reinforcement part, as described in EP-A-0 010 835, EP-A-0 252 338 and EP-A-0 530 507. Antistatic hoses which use this type of conductor have some acknowledged drawbacks, such as the considerable cost of the conducting material, the reduction in the overall flexibility and elasticity of the hose, the risk of breakage of the conductor and the consequent interruption of electrical continuity, and difficulty in connecting to the ground line.

In another example of embodiment, one of the layers that form the hose receives the addition of, or is covered with, electrically conducting materials so as to dissipate the accumulated charges, as described in EP-A-0 310 271, EP-A-0 470 606 and WO-A-95/30105. In this case, too, the hose has some drawbacks, which consist of its high production cost, considerable roughness, unevenness of the hose surface which is in contact with the stream, and limited elasticity and flexibility of the hose.

An aim of the present invention is to overcome the drawbacks described above by providing an antistatic flexible hose which is reliable and cheap.

An object of the invention is to provide a flexible hose with antistatic devices which are protected against impacts and abrasions.

A further object is to provide an antistatic flexible hose which can be easily connected to the ground line of the device.

A further object is to provide an antistatic flexible hose which has an excellent surface finish in the region of contact with the fluid, so as to reduce load losses of the stream.

A further object is to provide an antistatic flexible hose which can be easily obtained by virtue of conventional methods and has a relatively low production cost.

This aim, these objects, and others which will become apparent hereinafter are achieved by an antistatic flexible hose according to claim 1.

The semiconducting wire-like part can be arranged outside the base layer or inside it and can be at least partially embedded therein.

By virtue of this arrangement, the semiconducting wire-like part is fully integrated within the mass of the hose and is thus protected against the risk of damage and breakage.

Conveniently, the semiconducting wire-like part has a substantially helical shape, with a pitch which is substantially identical to the pitch of the wire-like part, and is located in a position which is adjacent and offset with respect to the wire-like part.

If the semiconducting plastic wire-like part is at least partially embedded in the base layer, it can be located toward the inner surface of the hose so as to be tangent thereto or at least protrude radially inward.

As an alternative, the semiconducting wire-like part can be arranged toward the outer surface of the base layer, so as to be tangent thereto or at least protrude radially outward.

In another embodiment, the conducting wire-like part can coincide with the reinforcing wire-like part, so as to be tangent both to the inner surface and to the outer surface or at least radially protrude with respect to both surfaces.

In any case, connection to a ground line is facilitated by the screwing of the end portion of the hose on a threaded connector of the apparatus on which the hose is fitted.

The semiconducting compound that forms the part can be constituted by a plastic matrix which has a relatively high electrical resistivity and in which a solid material with relatively low electrical resistivity is dispersed.

The solid material with relatively low electrical resistivity is preferably a powder based on carbon black.

Further characteristics and advantages of the invention will become apparent from the detailed description of some preferred but not exclusive embodiments of the antistatic flexible hose according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Fig. 1 is a partially sectional side view of a first embodiment of an antistatic flexible hose according to the invention, taken along an axial longitudinal plane;

Fig. 2 is an enlarged-scale view of a detail of Fig. 1;

Fig. 3 is a partially sectional side view of a second alternative embodiment of the antistatic flexible hose according to the invention, taken along an axial longitudinal plane;

Fig. 4 is an enlarged-scale view of a detail of Fig. 3;

Fig. 5 is a partially sectional side view of a third alternative embodiment of the antistatic flexible hose according to the invention, taken along an axial longitudinal plane;

Fig. 6 is an enlarged-scale view of a detail of Fig. 5.

With reference to the above figures, an antistatic flexible hose according to the invention, generally designated by the reference numeral 1, has an approximately cylindrical wall which is essentially formed by a base layer 2, which has a thickness S, with an outer surface 3 and an inner surface 4 which are substantially parallel to each other.

A wire-like reinforcement part 5 is embedded in the layer 2 and has an approximately circular transverse cross-section with a maximum diameter d_r which can be equal to, or different from, the thickness S. Part S is wound in a helical shape with one or more starts and with a substantially constant pitch P.

Preferably, the base layer 2 is made of a relatively elastic plastic material in order to give resiliency and flexibility to the hose as a whole. The reinforcement part 5 is made of a relatively rigid plastic material in order to give the base layer 2 rigidity in a transverse or radial direction.

By way of example, the materials of the base layer 2 and of the reinforcement part can be chosen among polymers such as PVC, PUR, PET or compounds thereof, in such proportions as to achieve the intended rigidity or elasticity characteristics.

Antistatic devices are provided to collect the electrostatic charges accumulated on the outer and inner surfaces of the hose as a consequence of friction with dust and in general with particles of insulating material.

According to the invention, these antistatic devices are constituted by a wire-like part 6 made of semiconducting plastic material, which has a transverse cross-section with a maximum diameter d_c. Thus, the semiconducting part 6 can be embedded in the base layer 2, which gives it a certain protection against any abrasion so as to increase its reliability. The semiconducting wire-like part 6 is wound in a helical shape which has a constant pitch P equal to the pitch of the reinforcement part 5. As an alternative, the wire-like part 6 can have an elongated shape which is parallel to the axis of the hose, so as to discharge the electrical charges along the entire length of the hose.

The material that forms the part 6 can be advantageously constituted by a matrix of an insulating plastic compound, that is to say a compound which has a relatively high electrical resistivity, with the addition of a solid conducting material, that is to say, a material which has a relatively low electrical resistivity.

Preferably, the material having relatively low electrical resistivity is constituted by carbon black powder.

The enriched compound must have a relatively low specific volumetric resistivity, for example between 2 and 20 ohm/cm and in any case sufficient to collect and discharge the electrostatic charges accumulated on the surface of the hose.

By way of non-limitative example, mention is made of the semiconducting compound manufactured and marketed by the multinational company Cabot under the registered trademark Cabelec(R), which is constituted by carbon black dispersed in a matrix of copolymers of ethylene and vinyl acetate. The specific volumetric resistivity of this semiconducting compound is close to 5 ohm/cm.

In the first embodiment, illustrated in Figs. 1 and 2, the wire-like semiconducting part 6 is arranged toward the outside, so as to be tangent to the outer surface 3 or protrude slightly radially outward with respect to the surface.

In this way, by screwing the hose onto the outer thread of a metal connector of an aspiration unit, not shown in the drawings, optimum connection to a ground line of the appliance is achieved through the connector.

In this case, the inner surface 4 of the hose is perfectly smooth, so as to reduce the load losses of the air stream inside.

In the second embodiment, shown in Figs. 3 and 4, the semiconducting wire-like part 6 is arranged toward the inside, so as to be tangent to the inner surface 4 or protrude slightly inward radially.

In this case, connection to a ground line can be achieved by screwing the hose to the outer thread of a metal connector of an aspiration unit.

The minimal inward protrusions of the helical part 6 will not appreciably alter the surface finish of the inner wall 4 of the hose, in any case ensuring low losses of hydraulic or pneumatic load.

In the third embodiment, illustrated in Figs. 5 and 6, the semiconducting wire-like part coincides with the wire-like reinforcement part 5. In other words, the reinforcement part 5 is made of the same semiconducting compound mentioned above, so as to perform both the structural function and the antistatic function.

In this case, the outer surface 3 and the inner surface 4 of the hose are both rather smooth, despite ensuring optimum protection of the semiconducting part.

In an alternative embodiment, not shown in the drawings, the part 6 can be arranged outside the base layer 2 but tangent thereto.

The hose according to the invention can be manufactured with a method for coextruding the components by means of a conventional commercial extrusion plate for plastic materials. In practice, the extrusion head generates, simultaneously and in axially and/or radially offset portions, a first extruded part, which has an approximately rectangular cross-section and forms the base layer 2; a second extruded part, which has an approximately circular cross-section with a diameter d_r and forms the reinforcement part 5; and a third extruded part which has an approximately circular cross-section with a diameter d_c, which forms the semiconducting part 6. By virtue of the mutual arrangement of the extrusion plates and of the presence of a rotating support, the three extruded parts generate three adjacent helixes which weld together so as to form an indefinite hose.

This method can be fully automated so as to allow a higher productivity than previous methods. This makes the final product cheaper even if the cost of the semiconducting compound is equal to the cost of conventional metal conductors.

From the above description it is evident that the antistatic flexible hose according to the invention achieves all of the intended aim and objects, in particular, its reliability, functionality and low cost are noted.

Although the invention has been described with particular reference to some preferred embodiments, it is evident that it is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept expressed in the accompanying claims. For example, the plastic materials of the base layer, of the reinforcement layer and of the semiconducting part can be different without thereby abandoning the scope of the invention.

CLAIMS

1. Antistatic flexible hose, comprising:
a base layer (2) of relatively elastic plastic material;
at least one first wire-like reinforcement part (5) made of substantially rigid plastic which is embedded in said layer of base material (2) in order to give it transverse rigidity, said reinforcement part (5) having a substantially helical shape with a preset pitch (P);
antistatic devices for dissipating electrostatic charges generated on the hose;
characterized in that said antistatic devices consist of a wire-like part (6) made of an electrically semiconducting plastic compound which is co-extruded together with said base layer (2).

2. Antistatic flexible hose according to claim 1, characterized in that said semiconducting wire-like part (6) is arranged outside said base layer (2).

3. Antistatic flexible hose according to claim 1, characterized in that said semiconducting wire-like part (6) is internal to said base layer (2) and at least partially embedded therein.

4. Antistatic flexible hose according to claim 1, characterized in that said semiconducting wire-like part (6) has a substantially helical shape.

5. Antistatic flexible hose according to claim 4, wherein said semiconducting wire-like part (6) has the same pitch

(P) as said wire-like reinforcement part (5) and is adjacent and offset with respect to said wire-like reinforcement part.

6. Antistatic flexible hose according to claim 4, wherein said semiconducting wire-like part (6) is arranged toward the inner surface (4) of said base layer (2) so as to be tangent thereto or at least partially protrude inward radially.

7. Antistatic flexible hose according to claim 4, wherein said semiconducting wire-like part (6) is arranged toward the outer surface (3) of said base layer (2) so as to be tangent thereto or at least partially protrude outward radially.

8. Antistatic flexible hose according to claim 4, wherein said semiconducting part (6) coincides with said wire-like reinforcement part (5).

9. Antistatic flexible hose according to claim 4, wherein said semiconducting compound is constituted by a plastic matrix which has a relatively high electrical resistivity, enriched with the addition of a solid material which has a relatively low electrical resistivity.

10. Antistatic flexible hose according to claim 9, wherein said solid material having relatively low electrical resistivity is a powder based on carbon black.

11. Antistatic flexible hose according to claim 9, wherein said matrix of plastic material comprises a compound of copolymers of ethylene and vinyl acetate.

12. Antistatic flexible hose according to claim 9, wherein said matrix of plastic material comprises copolymers such as PVC and PUR.

13. Antistatic flexible hose according to claim 9, wherein the specific volumetric resistivity of the plastic material of said enriched plastic matrix is between 2 and 20 ohm/cm and is preferably close to 5 ohm/cm.

14. Antistatic flexible hose according to claim 1, wherein the plastic material that forms said base layer (2) comprises a polymer such as PVC, PUR and PET or a compound thereof.

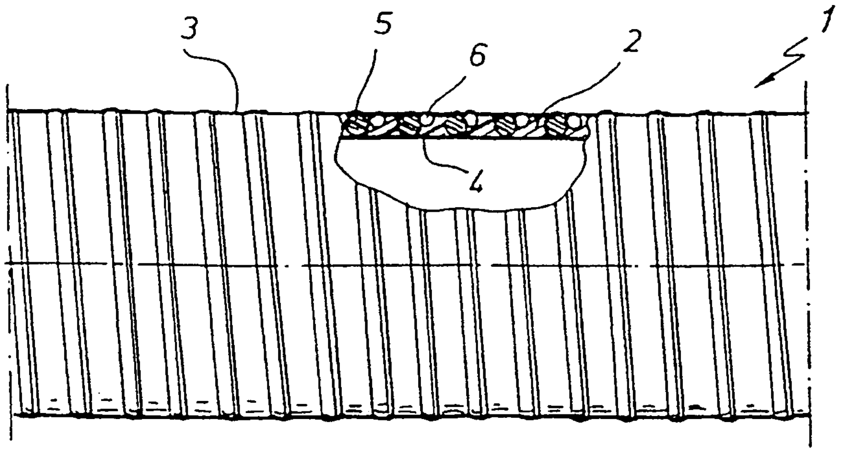


FIG. 1

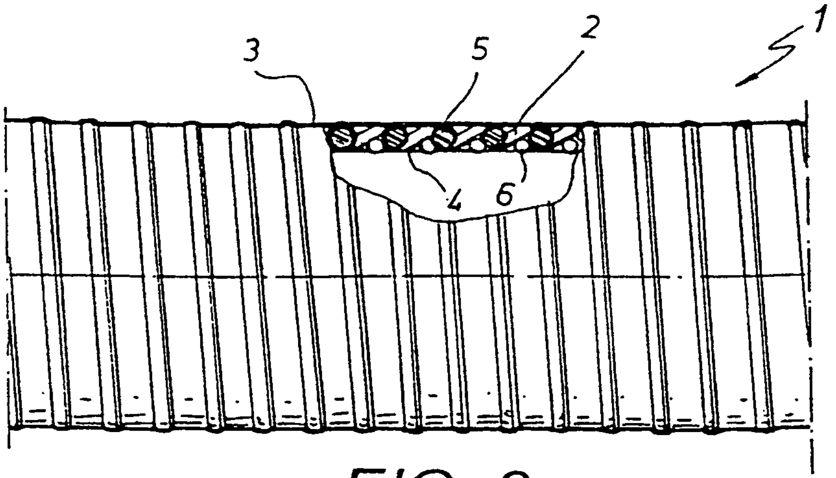


FIG. 3

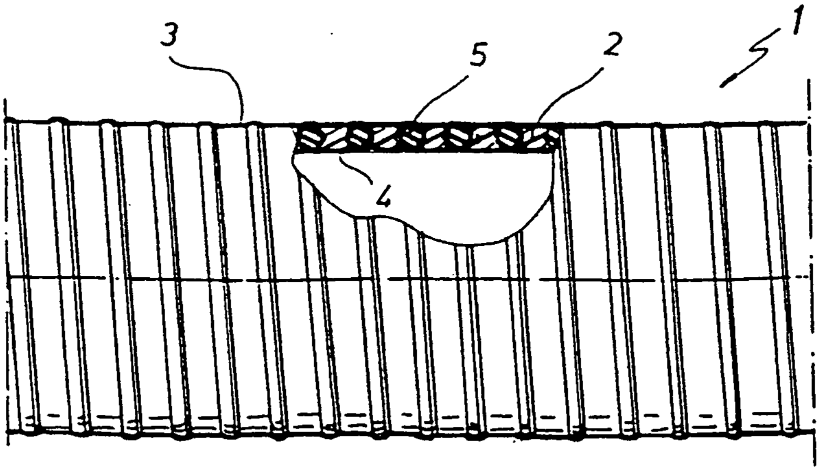


FIG. 5

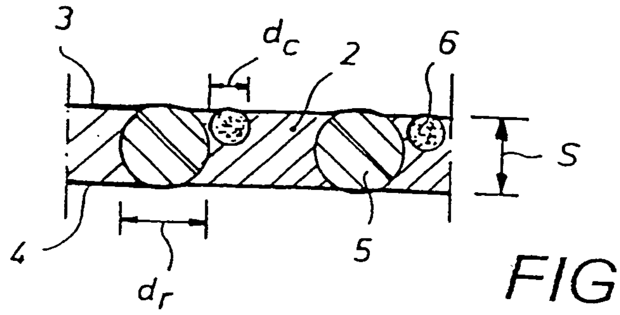


FIG. 2

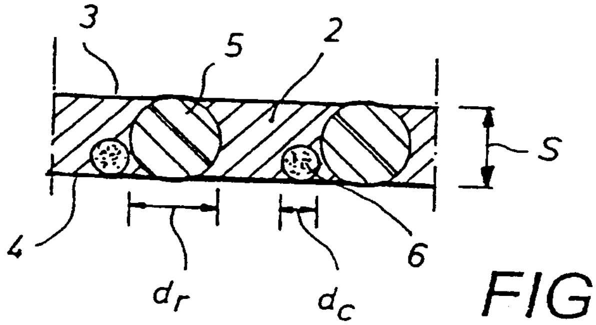


FIG. 4

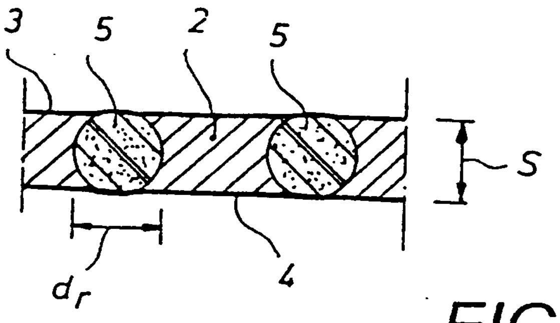


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 97/04949

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F16L11/08 F16L11/118 F16L11/127

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 870 535 A (MATSUMOTO) 26 September 1989 see the whole document ---	1,3,4,6, 8-12,14
Y	US 3 299 908 A (A. G. PETZETAKIS) 24 January 1967 see the whole document ---	1,3,4,6, 8-12,14
A	WO 81 01227 A (THE POLYMER CORPORATION) 30 April 1981 see claims 1-8; figure 1 ---	1,4,9,10
A	DE 31 45 702 A (O. M. ZEISSIG) 26 May 1983 see the whole document ---	1
A	US 3 558 754 A (M. MARTIN) 26 January 1971 see column 2, line 1-15; figures 1-7 --- -/--	1

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search
26 January 1998

Date of mailing of the international search report
02/02/1998

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer
Angius, P

INTERNATIONAL SEARCH REPORT

ernational Application No
PCT/EP 97/04949

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 252 338 A (INDUSTRIE PLASTICHE LOMBARDE S.R.L.) 13 January 1988 cited in the application see claims 1-3; figures 1,2 -----	1

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

ιernational Application No
PCT/EP 97/04949

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4870535 A	26-09-89	NONE	
US 3299908 A	24-01-67	NL 282600 A US 3290727 A	 13-12-66
WO 8101227 A	30-04-81	EP 0039363 A	11-11-81
DE 3145702 A	26-05-83	NONE	
US 3558754 A	26-01-71	NONE	
EP 252338 A	13-01-88	NONE	

POWERED BY Dialog

Anti-static flexible hose for conveying fluids - with helical wire like reinforcing and anti-static parts formed in relatively elastic base layers of synthetic material
Patent Assignee: FITT SPA
Inventors: MEZZALIRA R

Patent Family

Patent Number	Kind	Date	Application Number	Kind	Date	Week	Type
WO 9825064	A1	19980611	WO 97EP4949	A	19970910	199829	B
AU 9747019	A	19980629	AU 9747019	A	19970910	199845	
IT 1287373	B	19980804	IT 96VI202	A	19961206	200056	

Priority Applications (Number Kind Date): IT 96VI202 A (19961206)

Patent Details

Patent	Kind	Language	Page	Main IPC	Filing Notes
WO 9825064	A1	E	21	F16L-011/08	
Designated States (National): AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE GH HU IL IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG US UZ VN YU ZW					
Designated States (Regional): AT BE CH DE DK EA ES FI FR GB GH GR IE IT KE LS LU MC MW NL OA PT SD SE SZ UG ZW					
AU 9747019	A			F16L-011/08	Based on patent WO 9825064
IT 1287373	B			F16L-000/00	

Abstract:
WO 9825064 A

The hose is made up of a base layer(2) of relatively elastic synthetic material carrying at least one wire-like reinforcement part(5). This part(5) is made of substantially rigid synthetic material and is embedded in layer(2) as a helical shape with a pre-set pitch to give the base layer transverse rigidity.

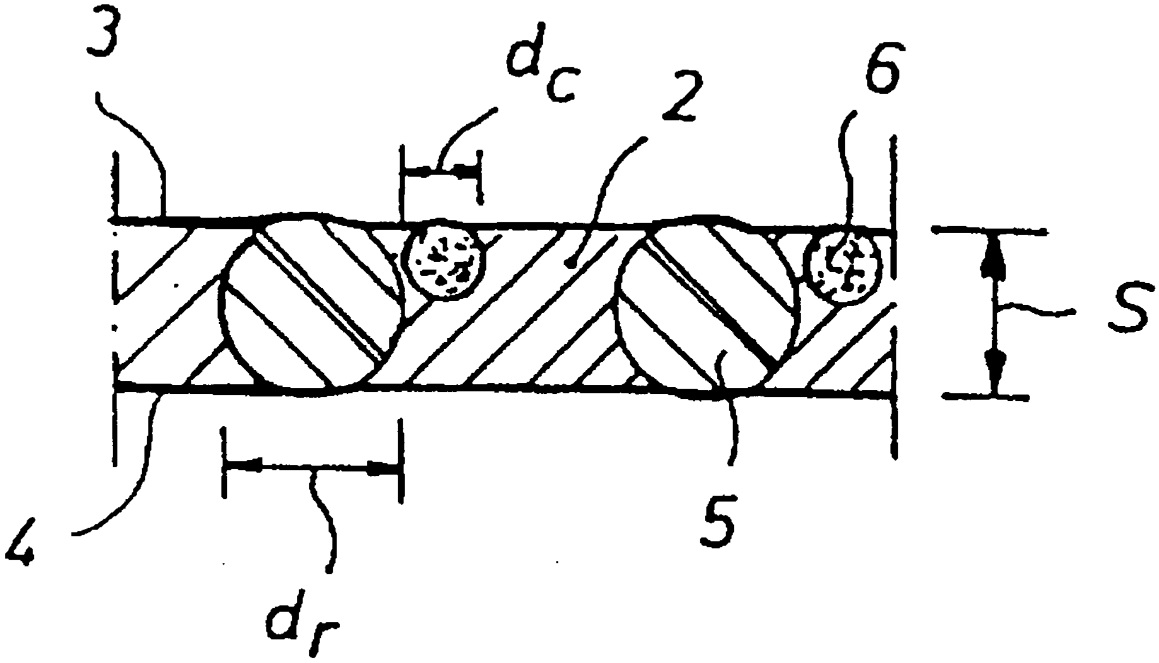
The anti-static part is made of an electrically semiconducting plastic compound(6) which is coextruded together with the base layer and is embedded in said base layer. The wire-like part(6) has the same helical pitch as part(5) and is disposed adjacent to and offset from said part(5). The offset may be towards the inner(4) or outer(3) surface of said base layer(2) as required.

USE - As anti-static hose for conveying fluids.

ADVANTAGE - Reliable cheap conventionally formed hose has anti-static part protected against

impacts and abrasion for easy connection to ground line while leaving smooth inner surface (4).

Dwg.2/6



Derwent World Patents Index
© 2004 Derwent Information Ltd. All rights reserved.
Dialog® File Number 351 Accession Number 11916528